P-24 Hazardous Operations Controls

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P-24 Group members are reminded that our goal is to strive for excellence in all of our experiments and operations. This can be achieved only when each individual becomes accountable for, and takes pride in, optimally performing the tasks for which he or she is responsible. Our motto could be:

P.I.E. = Pride In Excellence

I. Introduction

This is the basic safety tutorial for P-24 personnel and collaborators, including visitors working in P-24. It outlines the basic safety aspects of the group operations, and is the basis for all P-24 Hazard Control Plans (HCPs), Experiment Appraisals, and all Hazard Analysis and Training guidelines. This document does not replace any of the laboratory guidance documents, and is intended as basic information. This complements other requirements, which are a necessity for working in P-24 areas.

Detailed safety information about specific experiments or operations can be obtained from the specific experiment's HCP, Hazard Assessments or guidelines, or from the personnel involved. The experimental HCP and pertinent guidelines are posted at or near their respective operations. Training is always necessary for potentially hazardous operations, and must be documented as it is completed. Each individual, as well as the supervisor, is responsible for making sure that the necessary training is received. Employees shall be informed of possible medical hazards in their workplace, and receive written monitoring results when applicable. Employees shall also be informed of medical services and information available through ESH-2 occupational medicine during pre-employment briefing by ESH-13. Further guidance can be obtained from the Group Operations Officer.

Information about safety, rights, and obligations is dispersed by group meetings, team meetings, and by individual memo when necessary. P-24 subscribes to the Laboratory Stop Work Policy, and all personnel will be periodically reminded of this right.

A. Description of facilities

P-24 is located primarily at TA-35, with an operation at TA-3 and one at TA-46. Most of the experimental areas in the group are classified as hazardous (to some degree), and operate under HCPs. The main hazards are high voltages, x-radiation, and laser radiation. And knowledge of the HCP for each particular area is important. The area occupied by the group at TA-3 includes

building 316. At TA-35, P-24 occupies buildings 86, 87, 125, 126, 127, 128, 189, 207, 255, and 421. P-24 also has a Laser Lab at TA-46.

B. Description of operations

Group P-24 specializes in Plasma Physics, Lasers, and Pulsed Power experiments. There are a good variety of operations performed daily; however, most of these are not hazardous. All the experiments in P-24 must have HCPs on file that describes the hazards and operations. The HCP or Operating Guideline is reviewed annually, and is posted at or near the equipment. These documents are required reading in order to be authorized to work on the project.

II. Description of Hazards and Controls

A. Hazardous Materials and Operations

All chemical containers must be labeled. A current chemical inventory must be available in each area containing chemicals. In addition, all hazardous chemicals must have associated Material Safety Data Sheets (MSDSs). Each individual using hazardous chemicals must be familiar with the information and procedures described on the MSDS. Be aware that you may be required to generate an MSDS for materials you fabricate. The MSDS files are located in each experiment or facility for chemicals used in that facility. Most MSDSs are also available on a link from the Lab home page: **http://drambuie.lanl.gov/~msds/ohsqform.pl,** or **http://drambuie.lanl.gov/~esh5/internal/tox_msdsindex.html**

The following list of materials is considered hazardous to either people or the environment, and usage is governed by Government, Lab and/or Group regulations. In case of contamination or spills, contact the FMU-77 Waste Management Coordinator (**WMC**), **Quatro Baker**, 7-5144 / 996-0278. Or call Gene Linzey, P-24 Group Operations Officer, at 7-5030, or pager 996-3692.

1. Beryllium

The primary danger is producing airborne particulates which may be inhaled if not contained. A secondary danger is potential sensitization due to contact with the metal.

Cutting beryllium with scissors cannot produce airborne particulates. However, all cutting of the filters shall be done in a designated area. Only cutting thin samples with scissors is allowed. Any machining of beryllium must take place in a certified beryllium work area. Cloth or tissue wipes will be positioned beneath the filter when cutting to catch any particles which may fall. Wipes will then be disposed of as hazardous waste. Gloves must be worn at all times when handling filters. Beryllium will be ordered pre-cut from the manufacturer whenever possible.

2. Corrosive and Toxic materials

RCRA Controlled wastes ---- These substances are listed in the Resource Conservation and Recovery Act. If you generate this type of waste, you are required to take the RCRA Waste

Generator Course. Improper disposal of these wastes can cause problems, and researchers have gone to jail for violations of this law.

Hazardous Waste Disposal ---- You must be aware of the hazardous waste you have generated, in order to dispose of it properly. The waste generator is responsible for the disposal. Satellite Storage Areas (SSAs) are available at some facilities. Waste disposal is complicated and can be costly. If in doubt, ask **Quatro Baker** FMU-77 Waste Management Coordinator (**WMC**), 7-5144 / 996-0278. He must be informed of all hazardous waste you place in this area--surprises are not welcome.

If you are generating hazardous waste in an area without an SSA, you may temporarily store the waste in labeled Ziplok™ bags or bottles (depending on the nature of the waste), and dispose of it in an SSA either when you are finished or at the end of the day.

Acids and Bases ---- Use protective clothing, gloves and face shield. Do the work under a vent hood. Do not store acids with bases, nor in close proximity to organics. Use spill pans (or secondary containers) under containers. These materials must be disposed of as RCRA wastes. No chemicals of any sort are to be "disposed of" (or poured) down the drains.

Carcinogens ---- Carcinogens are listed in LS106-03.0. Accessibility must be controlled. HCPs or Special Work Permits (SWPs) are required for their use. Exposure should be kept As Low As Reasonably Achievable (ALARA). P-24 discourages their use if a suitable substitute is available.

Solvents ---- Flammable solvents such as ethyl and methyl alcohol, acetone, etc., in quantities greater than 1 pint must be stored in a clearly marked flame-proof cabinet. In addition, all ethanol in quantities greater than 1 pint must be kept under lock and key. No solvents of any kind may be dumped down the drains. Used solvents, separated by type and major contaminants, must be stored in clearly marked containers in an SSA until pick-up by ESH. Separate fluorocarbons from other solvents. The Laboratory's policy is that, by definition, a rag used with solvents (except for ethanol, alcohol, and acetone) is still hazardous waste even if the solvent has evaporated during use. In the case of alcohol, ethanol, and acetone, if the rag dries **as it is being used**, the rag may be disposed of in the trash can.

Oils ---- Used oils should be stored for pick-up: either for disposal, or for recycling. Oil may not be dumped down the drains. Store oil soaked rags or paper in a separate container in a SSA. NOTE: If rags have been used to wipe up non-hazardous oil, but are not saturated, they may be disposed of in the trash.

Heavy Metals ---- Lead is the most common heavy metal to be encountered because of its many applications in soldering and in radiation shielding. Inhalation or ingestion of lead fumes or dust should be avoided. Extensive or long-term soldering requires adequate ventilation or an active exhaust. Workbenches that are used for soldering should be frequently cleaned to prevent lead accumulation. Use solder with as low a lead content as possible. Solder scraps will be kept in a container labeled "Scrap Solder for Recycle". Lead bricks should be clearly identified as such, and coated to prevent wear if used for weights and/or vibration control. Lead bricks should never be used for doorstops, bookends, etc. ESH personnel conduct surveys for lead contamination of

areas that are used for soldering or other lead work. When the used solder container is full, JCNNM should be called to pick it up.

3. Radioactive Materials

Sources ---- P-24 has radiation sources that are used for instrumentation calibration. Most of these are rather low-level sources, but all source use is regulated through an HCP.

Radiation Producing Equipment ---- X-ray producing equipment and particle accelerators must have controlled access. HCPs are required, operators must be trained, and an operator's list must be posted on or near the equipment.

Radiation Exposure ---- It is the Laboratory and group policy to keep all personnel radiation exposure As Low As Reasonably Achievable. This means that personnel should not be exposed to radiation unnecessarily, no matter how low the level.

Assistance ---- Radiation monitoring assistance may be obtained by calling either Gene Linzey, 7-5030, Myra Stafford, 5-8213, or ESH-12 at 7-8085.

4. Compressed Gases

Compressed gas bottles must be secured when in use; also secured and capped while they are stored. Tubing and fittings connected to regulators must have appropriate pressure ratings or have a pressure relief valve. The regulators used with compressed gas bottles should always have a built-in pressure relief valve. When opening the valve be sure to stay to the side; the regulators have the potential of rupturing through their fronts and backs. Care should be taken to keep the regulators clean, which will help prevent malfunctioning. If you handle compressed gas bottles, safety shoes are required. A "Residual" tag must be attached to empty bottles, and call the Gas Plant in order for them to pick up the empty bottles. (Gas Plant: 7-4406) Personnel using and handling compressed gases must be trained by ESH-13 first. (Call 7-0059 to schedule training.)

5. Cryogenic Fluids ---- LIR402-580-01.0

P-24 frequently uses liquid nitrogen and helium. LIR402-580-01.0 outlines the guidelines and training required for these operations. This policy applies to the safe use of liquid nitrogen and helium. However, all cryogen handling requires an approved SWP or HCP.

6. Magnetic Fields

This issue is unsettled, and is still under consideration.

"These values should be used as guides in the control of exposure to static magnetic fields and should not be regarded as fine lines between safe and dangerous levels. (Emphasis mine.)

"Routine occupational exposures should not exceed 60 millitesla (mT), equivalent to 600 gauss (G), whole body, or 600 mT (6,000 G) to the limbs on a daily, time-weighted average basis [1 tesla (T) = 10^4 G]. Recommended ceiling values are 2 T for the whole body and 5 T for the limbs. Safety hazards may exist from the mechanical forces exerted by the magnetic field upon ferro-magnetic tools and medical implants. Cardiac pacemakers and similar medical electronic device wearers should not be exposed to field levels exceeding 0.5 mT (5 G). Adverse effects may also be produced at higher flux densities resulting from forces upon other implanted devices such as suture staples, aneurysm clips, prostheses, etc." [Quote from 1999 TLVs® and BEIs® page 141]

This excludes all small volume permanent magnets. Small volume ~ 5 Cu. I., but this is not law. (Agreed upon by Joe Labauve, ESH-5, by phone on April 28, 1999.)

7. Lasers ---- LIR402-400-01.1

Eye damage from a direct or reflected beam is the most common hazard associated with lasers. However, some lasers can produce fire or skin damage. There are four basic or major laser classifications: from Class I (normally, no hazard) to Class IV (can cause injury from either direct or reflected exposures). All lasers must be labeled with their proper classification, wavelength, and output power. Personnel working routinely in a laser environment must be registered as a laser worker. Protective eyewear must be worn in Class III and IV laser environments if there is a possibility of encountering the beam or its reflection. Direct viewing of Classes III and IV laser beams or their reflections is prohibited, even with protective eyewear. HCPs are required for all lasers > 50 mW.

8. Cranes ---- AR-13-2.

There are six cranes in P-24, and the group handles both light and heavy equipment. Individuals desiring to operate a crane in P-24 must attend the "Incidental Crane Operators" course and be certified by ESH-3. (Call 5-0079 for training.) P-24 has a Qualified Crane Operator, Peter Walsh, who is responsible for overseeing the "hands-on" training.

9. Forklifts ---- LIR402-1110-01.1.

There are several forklifts in P-24, and there is an operator assigned to each fork. Any individual desiring to operate a forklift must have ESH-13 training, and receive certification from a qualified instructor. (Call 5-0079 for training.) Always inspect the forklifts before the first operation of the day, using the checklist as a guide. Gene Linzey will give the "hands-on" training.

10. Government Vehicles

P-24 has vans, pickups, jeeps, sedans, and a flatbed. To operate them, one must be have a valid US drivers' license and be at least 17 years old. (See Gene Linzey for conditions.) Vehicles will be operated in compliance with all New Mexico Motor Vehicle regulations. Seat belts must be worn, and smoking is not allowed in the vehicles at any time.

11. Electrical Systems ---- LIR402-600-01.1.

P-24, because of the nature of its experiments, has a lot of high voltage power supplies and capacitor banks. The following procedures are generic, but read the applicable HCP for each project or experiment to which you may be assigned.

Laboratory policies and procedures for working around electrical equipment must be followed. These policies include the "two man rule" when any work is to be performed on energized or potentially energized equipment. All electrical equipment is to be considered both energized and dangerous until the equipment is positively grounded. All capacitors are to be kept grounded when the experiment is not in use. Unless capacitors are shorted, they should be considered in a charged state, and should be handled appropriately. Hazardous high voltage power supplies (those capable of supplying >5ma current) are to be energized unless interlocked barriers and warning lights are activated to warn and protect personnel in the area. No person shall work on energized equipment behind such a barrier alone even if another person is in the room. This situation invokes a "3-man rule". Note: the two-man rule means that 1) the second person is familiar with the hazards, 2) is only an observer, and 3) is currently trained and certified in CPR. Before any others enter into any experimental area, a trained operator must sweep the area and make sure the area is safe. Before any non-trouble shooting work is performed by anyone inside an interlocked area, a designated operator shall "safe" the equipment. A list of designated operators shall be posted beside the entry into such areas. The P-24 group leader, or a designated representative, must approve these operators. All procedures for making the electrical equipment safe shall be addressed in the HCP for each individual experiment. When not being operated, all high voltage systems and energy storage devices shall be grounded. Approved grounding operations shall be carried out only while wearing safety glasses.

12. Machine Shops

Machine shops shall be operated in accordance with the Physics Division Shop Policy.

13. Fires and Emergencies

Dial 911 in case of emergencies. The Building Emergency Plan covers most emergency situations. Remember that if there is an accident or emergency, the Safety Officer (the Group Operations Officer) or his backup must be notified immediately after calling 911.

Fires--- Be sure you know where the fire extinguishers and the emergency exits are located throughout the buildings.

B. Hazardous Operations

The two-man rule applies to all operations where incapacitating injuries could occur. This rule requires that at least two people will be in the room at the same time. In some cases, one person will perform the operation while another qualified, appropriately trained person only

observes. You might say that he/she is on "stand-by" watch. The following is a list of common hazardous operations where the two-man rule applies:

1. Machine shop and machine tool operations: All workers must be appropriately trained and approved for machine tool operation as well as trained and currently certified in CPR.

2. Powered hand tools: This includes portable saws, and drills having chuck capacities of greater than 3/8 inch.

3. Electrical Work: Working on hazardous energized equipment is always a two-man rule. For hazardous electrical work, the observer must be CPR trained and currently certified. **In electrical work, the observer may NOT perform work, but will actively observe.**

4. Lasers: If work is being done in the presence of materials which may dangerously interact with the exposed beam, **OR** if exposed high voltage sources equate hazardous electrical work, the two-man rule also applies.

5. Magnetic Fields: If the field is exposed in such a way as to allow personnel to exceed the maximum exposure as described in II.A.7 above, or there is a chance of being injured by flying magnetically attracted objects, the rule applies.

6. Cryogens: The two-man rule is in effect when the operations are non-routine.

7. Entry into Confined Spaces/Limited Egress areas: The two-man rule is always in effect in these areas. No exceptions. (At present, P-24 has none of these areas.)

8. Hazardous Mechanical Systems: High-pressure gas systems, rapidly rotating machinery, high-consequence fork lift operations, cranes etc. employ the rule.

9. Ladders, catwalks, or other elevated surfaces without adequate fall protection are included in the two-man domain.

C. Hazardous Working Environment

1. Machine shops ---- Safety glasses must be worn when working in P-24 machine shops. No loose clothing, loose long hair, or jewelry is to be worn around rotating machinery; i.e., nothing which could get caught in machines.

2. Safety shoes ---- shall be worn in any area or during any activity where there is a danger of heavy objects falling on your feet. Hard hats shall be worn in construction areas, and when you are working below overhead operations.

3. Noise ---- Earplugs must be worn when working in areas with hazardous noise levels. Such areas must be posted. ESH-5 can be asked to determine noise levels.

III. Safety Systems

A. Engineering Safety Systems

All safety systems are tested (or practiced) at regular intervals.

1. Fire ---- Know where the extinguishers and alarm boxes are in your areas. Call 9-911 to report fires. Know what the fire alarm sounds like in your area and what the evacuation paths are.

2. Warning Lights and Interlocks ---- to keep all personnel out of experimental areas during operations. Also, sweep reset switches are used to make sure areas are clear before operations begin. These operational safety procedures are spelled out in each experimental HCP and have to be approved by the Group Leader; and if necessary, Division and ESH personnel.

3. Building Evacuation ---- There are building evacuation plans and emergency plans for each building prepared by the FMs. These identify muster points and a list of people to call. Please be familiar with these plans. Reporting to the muster point is necessary to determine who might still be in the buildings.

B. Management and Administrative Controls

1. HCPs---- A Hazard Control Plan is required for operations that are complex and/or which involve real or potential hazards above a certain level. The P-24 Group Leader and possibly the Division Leader must approve HCPs before they are placed in effect. HCPs will be reviewed and updated annually to reflect operational changes and to improve safety.

2. Training ---- In addition to laboratory specified ES&H training, personnel will be given site specific and job specific training where applicable. Specific training and certification shall take place before exposure to the hazards. When possible, training and certification shall be through classes taught by the ESH-13 training section. Training records shall be kept and notices will be sent to personnel needing update training for re-certification. Frequency of required classes shall be determined by laboratory regulations or by group requirements. Job Specific Training related to each area will be determined by the section leader of that area and addressed in the HCP for that experiment/facility. All training will be jointly assessed with the Group Training Officer, Gene Linzey (7-5030) and White Rock Training Center (5-0079).

3. Special Work Permits ---- SWPs are short-term HCPs describing the procedures to be followed for a non-routine and/or potentially hazardous operation. The operations officer and the Group Leader will have oversight of most of them, with appropriate designated personnel such as the FM representative signing some when appropriate.

4. Inspections ---- All facilities and experimental space in P-24 will be inspected annually, and any safety/ES&H problems listed. Team Leaders will be assigned action plans for deficiencies in their areas, and follow-up inspections will be made to ensure that all the problems have been corrected.

5. Required Reading ---- HCPs, LIRs, and guidelines necessary for doing your job are required reading. Signed documentation at the end of each HCP is necessary to certify that you have read the appropriate materials.

6. Hazards Communication Program ---- The information about hazards are disseminated in the group in several ways, depending on the category:

General ---- Potentially hazardous situations of interest to the group as a whole. These hazards are discussed at group safety meetings, and training is provided for these hazards. The meetings are mandatory and are supplementary to the annual reading of the HCPs. As mentioned before, training is provided by ESH-13, and these courses are listed on a link from the Laboratory Home Page. For more information contact the group operations officer.

Specific ---- Potential hazards associated directly with your work. Training is provided by P-24 through HCPs and through Job-Specific Training. It must be remembered that training and safety is everyone's responsibility.

7. Safety Complaints ---- Concerns about safety should be reported to your team leader, the Group Operations Officer and Group Leader. There is also a procedure for filing a complaint directly with the DOE or the Department of Labor. A large poster in many areas (also at TA-35-86) describes this procedure.

8. "As Low As Reasonably Achievable" (ALARA) Program --- Research and development programs which produce ionizing radiation and/or use radioactive sources must comply with the **ALARA** program. The main objectives are to keep exposures to employees, visitors and the general public as low as reasonably achievable, as well as to provide records that the requirements of the program are being met. Procedures for the ALARA program are given in the HCPs for the affected experiments. All personnel working on or near radiation producing materials or devices must wear radiation badges. (All personnel working within TA-35 must wear them.) Employees receive a statement annually stating the exposure levels reached. Situations not addressed by an HCP must have a Special Work Permit for Radiation Work. All experiments using any radiation producing materials or equipment must be evaluated for meeting the ALARA requirements.

9. Lockout-Tagout ---- The Laboratory has an LIR for Lockout-Tagout. When followed, these procedures prevent the accidental energizing of a system or experiment. When appropriate, these procedures should be addressed by the individual HCPs or guidelines, or some other approved media.

10. Building Managers ---- Building Managers representing a Facility Manager are assigned to each building. Find out who the managers are for the buildings you work in. Report all facility-related problems to them.

C. Workplace standards

1. P-24 encourages its personnel to take the time and effort to keep work areas neat. This also includes efforts to clean up after one's self at the end of each shift, or at the end of a project such as a machining job in the machine shop. Unused tools and equipment should be properly stored to reduce clutter and lessen the chance of an accident.

2. Ladders, stairs and guardrails are to be kept clear of clutter and maintained in accordance with OSHA regulations.

3. Warning signs shall be placed at the entrance to all areas where hazards are present to warn personnel of hazards, and list precautions to be taken when in the area.

4. Shops shall be maintained in a neat and orderly manner. The Shop Supervisor is assigned the primary responsibility for the shop, and shall have final “say-so” of who works there. All the machinery shall have guards in place that conform to OSHA standards; and machines without guards shall be removed from operation until approved guards have been installed. No person shall work in a machine shop unless there is another person within hearing distance to fulfill the two-man rule. (Visual distance is best.)

5. Hand and power tools shall be kept in safe operating condition.

6. Compressed gas containers shall be stored upright and restrained from falling by the use of straps or chains. When not in use, valves shall be closed and valve covers shall be put in place. Proper and approved gauges shall be used for dispensing of all gases, and "adapters” between gas types will not be allowed.

7. Only personnel who have been properly trained shall handle cryogens. Proper safety protection shall be worn, including face and hand protection, when handling cryogens. Pressure relief valves shall be operable to prevent high-pressure buildup. Instruction for safe operation of cryogenic transfer equipment shall be available from the team leader or training through ESH-13.

8. Permanent welding and brazing areas must operate under an approved HCP or current Division policy. Welding or brazing operations carried out in other than approved areas must have an SWP.

Safety Concerns
Concerns about environment, safety or health with regard to your work or working area should reported to your Team Leader, Group Operations Officer, or Group Leader.